

THE RELATION OF TANNIN CONTENT OF SERICEA LESPEDA TO SEASON¹

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AS a forage crop for hay and pasture on land of low fertility in the southeastern part of the United States, few plants can compete in yield and drought resistance with sericea lespedeza, *Lespedeza cuneata* (Dum. de Cours) G. Don.³ It is probable, however, that the extended use of this plant has been retarded to some extent by conflicting reports regarding its palatability and feeding value. The literature dealing with these points has been adequately reviewed by Clarke, Frey, and Hyland⁴ and by Pieters,⁵ and need not be further discussed here.

Clarke, Frey, and Hyland⁶ suggested that tannin may be the cause for the apparent dislike some animals have for sericea and reported on the tannin content of samples of hay harvested at weekly intervals from May 29 to July 31. This is the period during which sericea would be cut for hay. They found a progressive increase in tannin up until the end of July, but had no data to show whether or not there was any change in the fall.

The tannin content of sericea during the latter half of the growing season would be of particular interest to those who use it for grazing. This is especially true since much of the controversy regarding palatability of sericea is based on observations of grazing animals.⁷

In the present report analyses are given of plants harvested throughout the growing season.

EXPERIMENTAL PROCEDURE

During the season of 1936, samples of sericea (*Lespedeza cuneata*, F.C. No. 17291) were harvested at Statesville, N. C., at 14-day intervals from May 5 to October 20. The material for analysis was all first-cutting hay obtained from square-yard areas on random-selected duplicate plots in a field seeded in 1931.

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³This perennial lespedeza has been called *Lespedeza sericea* Benth. up to the present time by the U. S. Dept. of Agriculture. According to the international nomenclature, however, it is *Lespedeza cuneata* (Dum. de Cours) G. Don and the name *Lespedeza sericea*, therefore, has been dropped as a scientific name for this plant. However, sericea, or sericea lespedeza, is used herein as a common name because it is already established and doubtless will continue to be used by farmers and others interested in the plant.

⁴CLARKE, I. D., FREY, R. W., and HYLAND, H. L. Seasonal variation in tannin content of *Lespedeza sericea*. Jour. Agr. Res., 58:131-139. 1939.

⁵PIETERS, A. J. *Lespedeza sericea* and other perennial lespedezas for forage and soil conservation. U. S. D. A. Circ. 534. 1939.

⁶Loc. cit.

⁷See footnote 5.

The green plant material was cured in paper bags in a well-ventilated, dark room. Moisture in the fresh material was determined by oven drying a portion at 100° C. After the samples were air-dry, the separation into leaves and stems was made.

The tannin content was determined by the hide-powder method of the American Leather Chemists' Association.⁸ This method gives what was designated by Clarke, Frey, and Hyland⁹ as total tannin. Fixable tannin was not determined. No tests other than the above-mentioned determination were made with the object of isolating and identifying the true tannin. The results, therefore, actually show matter absorbed by chromed hide powder under certain arbitrarily defined conditions. In preparing the extract solution for analysis, 25 grams of air-dry leaf and 50 grams of stem material were extracted separately by the reflux method of the American Leather Chemists' Association and each extract was made up to 1 liter. For removing tannin, 45 grams of wet, chromed hide powder were used per 200 ml of leaf extract and 15 grams for the same volume of stem extract.

The tannin concentrations in the leaf extracts varied from 2 to 4 grams of tannin per liter, the lower concentrations being for samples taken early and late in the season. The method specifies that the tannin concentration shall be not less than 3.75 nor more than 4.25 grams per liter. Lower concentrations may give high tannin values. However, results in which varying amounts of material were extracted or different amounts of hide powder were used indicate that they are not high by more than 0.2 or 0.3%.

RESULTS

Leafiness decreased with the aging of the plant from 75.7% in the first samples to 44.9% in the samples at the end of the season, as shown by Table 1. The plants started to bloom in late August and blossoms and seed were included in the leaf samples, which may partly account for the fluctuation in leafiness during August and

TABLE 1.—Percentage of leaves and stems in *sericea lespedeza* cut at 14-day intervals in 1936 at Statesville, N. C.

Date harvested	Moisture-free basis	
	Leaves, %	Stems, %
May 5.....	75.7	24.3
May 19.....	68.2	31.8
June 2.....	67.3	32.7
June 16.....	69.4	30.6
June 30.....	68.3	31.7
July 14.....	64.1	35.9
July 28.....	56.8	43.2
Aug. 11.....	56.2	43.8
Aug. 25.....	57.8	42.2
Sept. 8.....	50.2	49.8
Sept. 22.....	53.7	46.3
Oct. 6.....	51.2	48.8
Oct. 20.....	44.9	55.1

September. The stems reach their ultimate size by the time of first bloom so that the decrease in leafiness after the middle of August is due to dropping of leaves.

Data on the soluble solids and tannin contents are given in Table 2. Values for the whole plant were calculated from data for the leaf and stem portions. The soluble-solids content of the leaves increased from about 30% during the first part of May to 37% in July, then decreased to 27.7% at the end of the season. The content of soluble solids in the stems decreased throughout the season from about 23% to 14%. In the whole plant there was little change in soluble-solids content until the first of July after which there was a decrease from about 31% to 20%.

TABLE 2.—*Tannin content on moisture-free basis of sericea hays harvested at Statesville, N. C., in 1936.*

Date of harvest	Leaves*		Stems*		Whole plant†	
	Soluble solids, %	Soluble tannin, %	Soluble solids, %	Soluble tannin, %	Soluble solids, %	Soluble tannin, %
May 5.....	29.9	8.3	—	—	—	—
May 19.....	32.3	11.6	22.9	2.0	29.3	8.5
June 2.....	34.8	13.4	20.5	2.8	30.1	9.9
June 16.....	35.9	15.3	20.1	2.9	31.1	11.5
June 30.....	37.2	18.0	17.9	2.7	31.0	13.1
July 14.....	35.1	16.2	16.4	2.1	28.4	11.1
July 28.....	37.5	16.9	15.8	2.0	28.1	10.5
Aug. 11.....	32.6	13.9	15.4	2.0	25.0	8.7
Aug. 25.....	32.8	13.6	14.2	2.2	24.9	8.8
Sept. 8.....	30.2	12.0	15.1	2.0	22.7	7.0
Sept. 22.....	31.8	13.0	14.3	2.4	23.7	8.0
Oct. 6.....	27.6	7.8	13.9	1.8	20.9	4.9
Oct. 20.....	27.7	8.8	13.9	2.0	20.1	5.1

*Non-tannin values are not given but can be obtained by subtracting the figures for tannin from those for soluble solids.

†Calculated from values for the leaf and stem portions.

The tannin content of the leaves more than doubled between the first of May and the end of June, the increase being from 8.3% to 18.0%. After the first of July there was a decrease in tannin content and the last sample taken in the fall contained about the same amount of tannin as the first sample taken in the spring.

In October the leaf tannin was much lower than in September, the values being only 7.8 and 8.8% for the two October samples as compared with 12 and 13% for those taken in the preceding month. Part of this decrease in tannin was probably caused by seed for there was a considerable amount of mature seed in the October leaf samples. Aqueous extracts of ground seed and leaves will form a precipitate when mixed, possibly because of a combination of seed protein and leaf tannin. The proportion of seed in the October samples was not determined, but data on yields of hay and seed indicate that good stands of sericea should contain 10 to 15% of seed at seed harvesting time, which is in October. To obtain some quantitative data on the

effect of seed, a leaf sample containing 13.5% of tannin was mixed with enough ground sericea seed to form 12.5% by weight of the mixture. Analysis then showed only 10.1% of tannin in the mixture. If the seed had acted simply as inert matter 11.8% of tannin should have been found. The seed, therefore, caused a "loss" of 1.7% of tannin. Probably the October samples would have shown 10 or 11% of tannin if the seed had not been present; that is, there would have been only a moderate decrease in October instead of a relatively large one.

DISCUSSION

The increase in tannin content of sericea during the first part of the season is similar to that found by Clarke, Frey, and Hyland¹⁰ for their samples taken in Virginia in 1935. They found, however, a continual increase in tannin content up to July 31 instead of a maximum at the end of June, although the change during July was very small. Their last sample might well have been taken when the tannin content was highest for the season.

A maximum tannin content near the middle of the growing season has been observed for other series of samples taken in other years and seems to be a general rule. The difference in time at which the maximum tannin content was reached for the samples reported on here and those of Clarke, Frey, and Hyland may have been caused either by a difference in weather conditions during the two years or by a difference in actual age of leaves and stems, since growth starts earlier in the spring in North Carolina than in Virginia.

SUMMARY

Samples of sericea lespedeza were taken at 14-day intervals from May 5 to October 20, 1936, from a field at Statesville, N. C., seeded in 1931.

Leafiness decreased throughout the season.

Tannin in the leaves increased until June 30, then gradually decreased until September 22. The October leaf samples were appreciably lower in tannin than the September ones partly because of mature seed in the former. The first and last leaf samples collected contained less than half as much tannin as the midseason ones.

All stem samples were low in tannin.